AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators of agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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AGRICULTURAL NEWS LETTER

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PROTECTIVE WRAPPINGS FOR CHOICE GRADES OF CELERY

EDITOR'S NOTE: Vol. 8, No. 2 (March-April, 1940) of the "Agricultural News Letter" summarized the results of experiments conducted by the Texas Agricultural Experiment Station with moisture-proof "Cellophane" cellulose film as individual wrappers or liners in shipping containers for cucumbers. Excerpts from Texas Bulletin 576 were quoted to show that the "Cellophane" helped preserve the weight, color, turgidity, texture, flavor, and palatability of the cucumbers. It is, however, generally agreed that research dealing with the packaging of farm products has not been given the attention it deserves. Despite this, increasing competition among growers of a given crop has focused attention on the problem and the need for such research. There is, in fact, a growing demand for information about attractive protective wrappings suitable for packaging choice grades of perishables. Growers of celery, for instance, have tried a number of different kinds of wrappers over a period of years. More recently, as discussed in the following article, growers throughout the country have been obtaining exceptionally satisfactory results by wrapping their celery in specially designed color-printed "Cellophane". ("Cellophane" is a trade-mark of E. I. du Pont de Nemours & Co.)

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Commercially grown celery has long been marketed in a more or less haphazard way. For many years it was merely rough-washed in a tank of water, packed into crates, and shipped to market, leaving the housewife to wash it clean after she bought it and carried it home. Little change took place for many years, except to improve the variety and flavor, and to blanch the celery before shipping.

With the advent of shipments to large centers where the retailer had little space or time to improve the appearance of the celery, the individual known as the re-washer came into the marketing picture. He bought celery as it was shipped from the field, washed it, tied it into bunches, and made it ready for delivery to the retailer. As competition grew, the re-washers began wrapping their celery in parchment paper to enable them to identify their brands and to give the celery a little better eye appeal on the retail counter. Unfortunately, the paper was sometimes used to cover bruised stalks and poorly washed bunches.

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As competition became even keener, some of the growers began washing their own celery, trimming it a little more, and packing it ready to be sold in the retail stores. However, they followed the same method used by the re-washers and the retailers.

As the public became more sanitation-conscious, and as various food products began to appear in more attractive forms, the producers of celery became interested in ways of presenting their choice grades to the public in a condition that would make their product look more appetizing, and that would have quality appeal.

It was only natural when the celery was scrubbed and polished, bruised stalks removed, and prepared ready for use, that these stalks be covered in some manner to preserve their cleanliness and good appearance.

A few years ago some of the more progressive celery growers, wishing to secure the maximum eye and appetite appeal for their selected quality grades, set up a system of inspection and preparation, identifying their celery with printed parchment bands. These stalks were then wrapped in a special grade of moisture-proof "Cellophane" cellulose film so the public could recognize this high-grade well-prepared product.

"Cellophane"-Wrapped Celery Ripens and Improves in Condition

It was then found that celery wrapped in this protective covering ripened and improved in condition during shipment and display. The stalks stayed crisp and took on a sweet, nutty flavor due to the retention of moisture within the package and exclusion of the oxidizing air around the roots.

Several chain stores soon recognized the advantages of handling this high-grade "Cellophane"-wrapped product. The soundness of their judgment was proved by the ready acceptance of this choice, clean sanitary celery by the public.

Today, some of the largest producers of celery in both the North and South have set up plants near their fields. Here they select the choice grades, carefully wash the stalks, strip off bruised leaves, trim the root ends, pre-cool in ice water, and wrap about two-thirds of the stalk in specially designed color-printed "Cellophane". Naturally, the grower is more careful in selecting the celery that goes to market with his name on the package. The chain stores and the public recognize this, and are quick to buy the better grade.

Because the celery so marketed is washed and ready to put on the table, it saves the housewife time and enables her to buy a product which has no waste. She is glad to pay the slight extra cost.

While much time and effort have been spent by research agencies to improve varieties of farm products, very little has been done to determine the best way to present these improved products so that they can be recognized by the housewife. Shipping crates may be carefully marked with the grade and variety, but rarely

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is this information made available to the housewife at the point of sale. However, this new quality-identified "Cellophane" package enables the housewife at a glance to know that this particular bunch of celery has been carefully selected and prepared for her use. And in the future, even more information can appear on the package, including recipes and suggested uses and ways of preparing and serving.

Many merchandising men believe the time is not far distant when all fruits and vegetables will be more carefully packaged and identified. This trend is indicated by the use of tissue wrappers printed with trade-marks and other identifying symbols which make it possible for the housewife to recognize and repeatedly ask for the product she prefers.

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UREA AS A SOURCE OF PROTEIN FOR SHEEP

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EDITOR'S NOTE: The Agricultural Extension Service of the University of Illinois recently issued a mimeographed report giving results of a series of experiments on the value of urea in feed for sheep. This report is published in full herewith by permission of the authors. Additional information regarding urea as a feed for ruminants is included on page 7 of this issue under the heading "Control Officials Authorize Use of Urea in Feeds for Ruminants".

Feeds which are high in protein are usually the most expensive part of a ration. Hence, many feeding trials at experiment stations have dealt with the relative merits of different protein concentrates.

Nitrogen is found in all proteins, and the protein content of a feed is based on its nitrogen content multiplied by 6.25. Nitrogen exists in many substances which are not proteins. One such substance is urea. Urea contains about 46.5 percent nitrogen. If this is multiplied by 6.25 it equals a protein content of 290.6 percent. If animals could use this non-protein nitrogen, a very small quantity of urea would replace a large quantity of protein. Laboratory tests with lambs showed they were able to use the nitrogen of urea. Apparently only ruminants such as sheep and cattle can use such nitrogen to a significant extent because in the paunch of these animals bacteria change the nitrogen from a non-protein form to a protein form. The sheep then utilize this bacterial protein. The urea used was a manufactured product and was valued at $90 per ton, but probably can be produced at a lower cost. On the basis of protein equivalent, it is considerably cheaper than most protein feeds per pound of protein.

To test the use of urea under practical feeding conditions after its use in the laboratory, thirty head of Texas fine-wool yearling wethers were used. Fifteen of them were fed soybean oil meal, and fifteen were fed urea in quantities to provide equal amounts of nitrogen. Otherwise, the same feeds were used for both groups. However, since urea does not provide any energy to the animal, the amount of energy supplied in the soybean oil meal was made up by using more corn for the urea-fed group of sheep. The concentrate portions of the rations were composed as follows: Lot 1 - ground shelled corn, 100 pounds; soybean oil meal, 20 pounds; limestone, 2.5 pounds; and Lot 2 - ground shelled corn, 120 pounds; urea, 3.09 pounds; and limestone, 2.5 pounds. All sheep had

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access to salt and water. In feeding, the corn silage (used for the first 28 days) or cut alfalfa hay was put in the feed racks and the concentrate mixture placed on top of this roughage.

The test covered 84 days, April 26 to July 19, 1940. During this period the sheep were in dry lot, and the following summarized data were obtained.

Weight and Feed Record
(All figures of weights are in pounds)

	Lot 1			Lot 2		
Av. final weight	97.3			94.8		
Av. initial weight	69.5			69.5		
Av. gain	27.8			25.3		
Av. daily gain	.33			.30		
Feed record	Daily	Total per sheep	Per 100 lbs. gain	Daily	Total per sheep	Per 100 lbs. gain
Ground corn	1.39	117.06	421.1	1.61	135.13	534.1
Soybean oil meal	.28	23.41	84.2	—	—	—
Urea	—	—	—	.041	3.48	13.7
Limestone	.035	2.93	10.5	.033	2.81	11.1
Corn silage[1]	2.48[2]	79.3	476.2	2.43[2]	77.8	517.3
Alfalfa hay	1.02[3]	53.1	—	1.02[3]	53.1	—
Feed cost[4]	2.4¢	$2.04	$7.34	2.5¢	$2.12	$8.28

[1] Calculated on 28-day period. Silage was fed about the first 32 days, alfalfa hay fed for the last 52 days. [2] Average for 32 days. [3] Average for 52 days.
[4] Feed costs: Corn, 60¢ per bu.; SBOM, $25 per ton; Urea, $90 per ton; Corn silage, $4.00 per ton; Alfalfa hay, $12 per ton, Limestone, $12 per ton.

During the first four weeks the same amounts of feeds were given to both groups of sheep. If one lot did not eat all its feed at a given feeding and a smaller amount was fed at the next feeding, the amount for the other lot was reduced similarly. However, after the first four weeks this plan was not followed, and both groups were fed such amounts as they would eat. The ration containing soybean oil meal was always eaten in less time than the ration containing urea, but the average amount eaten per sheep was not greatly different. Urea does not have a pleasing taste, and the small amount of urea (3.09 pounds to 120 pounds of ground corn) gave the mixture a rather noticeable unsavoryness. This ill-flavor probably explains the longer time in eating the ration by the sheep of Lot 2 compared with those of Lot. 1.

On an average, the sheep of Lot 1 were fed 117.06 pounds of corn, 23.41 pounds of soybean oil meal, and 2.93 pounds of limestone or a total of 143.4 pounds of concentrates. For Lot 2 the quantities were 135.13 pounds of corn, 3.48 pounds of urea, and 2.81 pounds of limestone, a total of 141.42 pounds of concentrates per head. The same amounts of alfalfa hay were fed in both lots, but

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Lot 1 received 79.3 pounds of corn silage per head compared with 77.8 pounds per head for Lot 2. Refuse fed totalled 3 pounds of concentrates and 17 pounds of roughage for Lot 1 and 32 pounds of concentrates and 25 pounds of roughages for Lot 2.

The sheep of Lot 1 required 421.1 pounds of corn, 84.2 pounds of soybean oil meal, 10.5 pounds of limestone, and 476.2 pounds of roughage, worth $7.34 (at prices used) for each 100 pounds of gain. In comparison, those of Lot 2 required 534.1 pounds of corn, 13.7 pounds of urea, 11.1 pounds of limestone, and 517.3 pounds of roughage per 100 pounds gain, costing $8.28. This is, of course, a difference in cost of some importance. The sheep of Lot 2 averaged 2.5 pounds per head less gain than those of Lot 1. This difference in rate of gain does not possess significance from a statistical standpoint. Hence, the difference in feed costs of gains may also be of doubtful significance as a repetition of the trial may yield contradictory results. Nevertheless, the results suggest that practical feeders await further trials before deciding to replace standard protein supplements with urea.

The carcasses of both lots were graded almost the same by the members of the Bureau of Agricultural Economics of the United States Department of Agriculture. Eighteen legs, nine from each lot, were obtained for palatability tests. These were cooked, and the tests conducted in cooperation with the Department of Home Economics of the University of Illinois. Evidence was not obtained which would show that the use of urea lessened the quality of the meat in any way. In three cases the roasts from the urea-fed group were rated superior to those from the group fed soybean oil meal. In four cases those from lambs fed soybean oil meal were favored over the roasts from urea-fed lambs and in two cases there was no difference.

CONTROL OFFICIALS AUTHORIZE USE OF UREA IN FEEDS FOR RUMINANTS

EDITOR'S NOTE: Until recently non-protein nitrogen compounds, such as urea, were considered of little or no value in feeds. In the last four years, however, scientists at a number of State Agricultural Experiment Stations, have developed considerable new information, based on carefully controlled feeding tests with dairy cows and sheep. These data show that ruminants can utilize urea nitrogen as well as protein nitrogen. The following is a brief statement regarding the action of feed control officials accepting urea as an ingredient in proprietary feed for cattle, sheep, and goats.

Ruminants Manufacture Protein from Urea

Investigations at the Wisconsin, Illinois, and Massachusetts Agricultural Experiment Stations* show that when urea is fed to ruminants, they convert the urea to protein. This is done by bacterial action in the rumen or paunch of the ruminant. The newly-formed protein is subsequently digested in the fourth stomach and intestine.

Non-ruminants cannot utilize urea nitrogen, because the urea is not converted to bacterial protein in single-stomached animals.

Resolution Regarding Use of Urea in Proprietary Feeds

The use of urea as a source of nitrogen (protein) for ruminants was considered at the recent annual meeting of the Association of American Feed Control Officials in Washington, D. C. The results of the urea feeding experiments at the Wisconsin and Illinois Experiment Stations were briefly reported by W. B. Griem of Wisconsin. The Association adopted the following resolution regarding the use of urea in proprietary feeds:

> "Be it resolved: that urea and ammonium salts of carbonic acid are acceptable ingredients in proprietary cattle, sheep, and goat feed only; that these materials shall be considered to be adulterants in proprietary feeds for other animals and birds; that the protein equivalent of combined urea and ammoniacal nitrogen be no greater than one-third of the total crude protein nitrogen; and that the following statement of guarantee of crude protein for feeds containing these materials be recommended: Crude Protein, not less than ..... per cent (This includes ..... per cent Equivalent Crude Protein from non-protein Nitrogen)."

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*Results of the Wisconsin work with dairy cattle were reported in Vol. 8, No. 5, of our "Agricultural News Letter". Results of the Illinois work with sheep are reported on page 4 of this issue. Reprints will be sent on request.

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Method of Determination of Urea Content of Feeds Presented to A.O.A.C.

A method for the chemical determination of the urea and ammonia nitrogen content of feeds was presented at the annual meeting of the Association of Official Agricultural Chemists at Washington, D. C. The method is simple, and the results reported by several collaborators were in close agreement.

Urea Should Be Used in Concentrate or Grain Mixture

Urea contains 46.6% nitrogen, equivalent to 290% protein. The addition of about 6.9 pounds of urea per ton of concentrate or grain ration, therefore, will increase the protein equivalent content around 1.0 per cent.

Urea should be used in the concentrate or grain mixture at the rate of not less than 20 pounds and not more than 60 pounds of urea per ton of grain mixture. Its use should be restricted to beef and dairy cattle, sheep, and goats. Urea should never be used in feeds for horses, hogs, poultry, or any kinds of livestock other than ruminants.

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A NEW PLASTIC FRUIT AND CAKE KNIFE

Coal, air, and water now have been converted into a transparent, keen-edged knife which is expected to prove a boon to agricultural research workers. The knife, which also is designed for household use, is fashioned of "Lucite" methyl methacrylate, the Du Pont shatter-proof plastic, and is believed to be superior to steel for several purposes.

In agricultural research, it can be used for cutting citrus fruits without fear of corrosion. The cutting edge is finished with tiny, saw-like teeth which can be renewed in a few seconds by scraping the "Lucite" blade and then tapping the edge at right angles.

The blade is extremely keen but the knife is unusually safe. It should always be used in a saw-like manner for effectiveness. Since this must be done deliberately, there is less chance that the user will cut himself.

An anti-sticking principle is applied to the knife for cutting soft materials. A row of six holes is arranged down the middle of the blade to prevent the vacuum which ordinarily occurs when soft material is cut.

Blade and handle are molded in one piece. This makes for sanitation. The knife is extremely lightweight compared with ordinary knives used in the laboratory or home.

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PHENOTHIAZINE FOR THE ANTHELMINTIC TREATMENT OF SHEEP AND GOATS

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EDITOR'S NOTE: The Du Pont "Agricultural News Letter", Vol. 8, No. 6, November-December, 1940, carried a brief summary of the development of phenothiazine, the new anthelmintic. It listed the types of animals which are benefited by treatment with this new drug, and tabulated dosages, methods of administration, and advantages of phenothiazine for sheep and goats, horses and mules, cattle, poultry, and swine. Because of the widespread interest shown by stock raisers, veterinarians, county agents, agricultural experiment station workers, and others, additional articles will be presented from time to time. The following is restricted to information on the treatment of sheep and goats. Subsequent articles will deal with treatment of other animals.

Anthelmintics commonly used for sheep include copper sulfate, nicotine sulfate, carbon tetrachloride, tetrachlorethylene, and others. Most of these drugs are effective against only one type of parasite, and show little or no action against other important types of worms. For example, copper sulfate or mixtures of copper sulfate and nicotine sulfate are of value in removing common stomach worms, but are of little value in controlling nodular worms, hookworms, bankrupt worms, large-mouthed bowel worms and certain other parasitic worms.

Dr. Paul D. Harwood and co-workers at the U. S. Department of Agriculture, Bureau of Animal Industry, were the first to conduct experiments with phenothiazine on sheep and first published their results in July, 1939. They have continued their experiments, and have published several additional papers. Other parasitologists and veterinarians have taken up this study, and have also published results corroborating and extending the work of Harwood. For example, publications by W. E. Swales of Macdonald College (Canada), H. McL. Gordon of McMaster Animal Health Laboratory (Australia), and E. L. Taylor and K. N. Sanderson of the Veterinary Laboratory, Ministry of Agriculture (England), are of outstanding interest.

The following summary is based not only on published reports of experiments, but on discussions with manufacturers of veterinary supplies and stock remedies who have gained practical commercial experience with the drug during the past several months.

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DOSAGE:

Most investigators agree that the proper dosage for adult sheep is 25 grams and for lambs weighing up to 50 or 60 pounds, 12 to 15 grams. In most cases, the full dosage is given the animal at one time; however, the question of administering smaller quantities in repeated daily doses has recently been the subject of some preliminary research. To date, there is not sufficient evidence available to indicate the relative merit of these two dosage procedures.

It is not possible to make any general recommendations concerning the frequency with which the drug should be administered. Considerable research is in progress on this point. The best advice at present seems to be that the treatment should be given as often as the sheep show obvious symptoms of infestation.

EFFICIENCY:

Harwood and co-workers report 90.9% removal of nodular worms, 76.7% of hookworms, and 100% of the lesser stomach worms. They also report it to be fairly effective in removing the common stomach worm. These results were obtained from a dose of 0.5 gram phenothiazine per pound of body weight. Swales used a dose rate of 0.4 gram phenothiazine per pound of body weight, the phenothiazine being incorporated in tablets containing phenolphthalein, starch, effervescent salts, tartaric acid, and dried ox gall. His experiments resulted in complete removal of both the common and lesser stomach worms, nodular worms, and large-mouthed bowel worms; almost complete removal of hookworms; and an efficiency against bankrupt worms of more than 51%. Taylor and Sanderson summarize their observations of experiments conducted on sheep with the statement, "Extensive trials suggest that in doses of 15 to 30 grams (0.5 to 1 gram per kilogram of body weight), phenothiazine has a remarkably good anthelmintic effect on sheep. The efficiency of its action was around 100% for worms in the fourth stomach, and 80% for most of the worms in the small intestines". LaPage has shown that a dosage of as little as 5 grams per sheep is considerably more effective than a standard treatment with copper sulfate.

METHODS OF APPLICATION:

Four general methods of treatment are now in common use, although it is possible that additional methods will be developed as further experience is gained.

Unmodified Powder:

Although phenothiazine in powder form is essentially odorless and tasteless, sheep will consume the drug much more readily if it is mixed with feed, and preferably with various agents such as molasses to increase the palatability. Harwood has proposed the following formula:

Phenothiazine.....	25 grams
Equal parts of oats and bran.....	450 "
Molasses.....	30 "
Water.....	30 "

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Harwood adds that "limited experience indicates that dried sugar-beet pulp may be substituted in the formula for all ingredients other than the drug. Sheep varying greatly in size should not be treated at one time. Ewes should be treated separately from rams, and lambs should be separated from adult animals". It is stated further that when medicated feeds are employed in mass treatments of this nature, it is always possible that a few individuals will not partake adequately of the medicated mixture. Consequently a certain amount of surveillance is necessary at the time of treatment. Weak animals should be treated separately, and watched to make sure they consume a sufficient quantity of the mixture. There should be enough trough space so that all animals can partake of the feed at the same time.

Gelatine Capsules:

Use of phenothiazine in capsule form permits close control over the dosage for each animal. While individual handling of the animals is involved, administration of the capsules is comparatively simple and is said to give very effective results. The drug may be compressed into tablet form, with or without modifying agents, and several of these tablets enclosed in a gelatine capsule. However, since considerable bulk is involved, it is usually necessary to administer two or more capsules to obtain the required dosage. Smaller sized capsules are available for the treatment of lambs.

Compressed Bolus:

Several manufacturers are offering the bolus type in various shapes and sizes, both with and without modifying agents. Administration of phenothiazine in this form is subject to the same comments as apply to the gelatine capsules.

Aqueous Suspensions:

Phenothiazine is extremely insoluble in water, but a relatively stable aqueous suspension, which can be administered to animals as a liquid drench, can be made by mixing the drug with certain wetting or dispersing agents. These aqueous suspensions are usually administered with a standard dosing syringe. The concentration of the suspension is generally so adjusted that two ounces of the liquid contains the proper dosage for adult sheep. However, since the concentration varies with different manufacturers, the directions given on labels should be closely followed.

SAFETY:

One of the advantages of phenothiazine for treating sheep is the comparative safety with which it can be used. Experiments conducted by Taylor and Sanderson indicate that no adverse effects were obtained after administration of 400 grams in a single dose. The same authors report, however, that repeated doses of 10 grams daily for 16 days brought about fatal results with one animal. Since a therapeutic dose is usually 25 grams, it would seem that an unusually

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high safety factor can be associated with this treatment. It should be pointed out, however, that since phenothiazine is a new drug, it is possible that further investigation may develop information which will impose limitations on its use under special circumstances. No reports of this kind have as yet come to our attention. Most veterinarians are familiar with this new drug, and questions pertaining to treatment should be taken up with them.

TREATMENT OF GOATS:

Goats are closely related biologically to sheep, and in general are infested by the same types of internal parasites. As anticipated, phenothiazine has been found very effective for treating goats, and several concerns are recommending their products for these animals. There is some evidence to show that the milk of treated goats develops a pinkish tinge for a few days following treatment. It is suggested, therefore, that milk from treated animals be used for purposes other than human consumption for a few days following treatment. The same recommendations for administration of phenothiazine to sheep apply to its use for treating goats.

STAINING OF WOOL:

It has been observed that the urine of treated sheep or goats, although of normal color when first excreted, develops a pink to red tinge when exposed to air. This color change is due entirely to the oxidation of decomposition products from phenothiazine with the formation of a colored dye known as thionol. If proper precautions are not taken, the discolored urine is likely to cause staining of the wool with a resultant decrease in the value of fleece. It is suggested that, following treatment, the animals be kept on thick bedding or on the ground where the urine will be absorbed quickly. It has been reported to us that the discoloration disappears under normal conditions after a few weeks.

GENERAL ADVANTAGES OF PHENOTHIAZINE TREATMENT:

The general advantages of this new anthelmintic may be listed as follows:

1. Very high efficiency for most of the parasites which commonly infest sheep and goats.
2. Remarkable lack of toxicity.
3. Lack of taste.
4. No fasting or previous preparation of the animal is required.
5. No subsequent purgation is required.

AVAILABILITY:

The Du Pont Company manufactures phenothiazine only in the bulk powder form, and is offering the product to manufacturers of stock remedies or veterinary supplies who are in position to formulate properly, and to package the material with adequate directions for use. These manufacturers have in every case made application to the Food and Drug Administration covering products which they offer for sale.

MISSISSIPPI EXPERIMENTS SHOW IMPORTANCE OF USING NEUTRAL FERTILIZERS

EDITOR'S NOTE: There are several factors that cause agricultural soils to be unproductive. One of these is excess acidity. Many soils in the humid, fertilizer-consuming sections of the United States are naturally acid. The continued use of acid-forming fertilizers on such soils gradually reduces their productivity unless proper supplements of liming materials are applied at intervals. The effect of various nitrogen fertilizers on the reaction of soils, as discussed in the following article, is a definite factor influencing their efficiency. The importance of recognizing this property of nitrogen fertilizers in the formulation of complete fertilizers is shown by the results reported by Anthony, Pitner, and Dorman, in Mississippi Agricultural Experiment Station Bulletin No. 338, "Neutral Versus Acid Fertilizer".

Manufacturers frequently formulate their fertilizers to be neutral or non-acid-forming. To do this, they add enough dolomitic limestone to compensate for the potential acidity of fertilizer materials that may tend to make soils more acid.

The importance of using non-acid-forming (neutral) fertilizer on soils that are not alkaline has been demonstrated in numerous experiments in many Southern and Eastern States. For instance, experiments conducted by the Mississippi Agricultural Experiment Station show that the yields of cotton obtained from neutral fertilizers were much higher than the yields obtained from acid fertilizers on the sandy soils of that State. In fact, the average increase from neutral fertilizers on sandy-textured soils in 17 counties was 89 pounds of seed cotton per acre, as shown in the following table:

Neutral vs. Acid Fertilizers

Soil Texture	Number of Tests	Number of Years	Acre Yield of Seed Cotton (Pounds)		
			Neutral Fertilizer	Acid Fertilizer	Increase
Sandy	11	5	846	756	90
Sandy	5	4	759	655	104
Sandy	6	3	846	774	72
Weighted Average	22		817	728	89

On the basis of these results, one ton of neutralized fertilizer applied on five acres of sandy-textured land would produce an increase over acid fertilizer of 445 pounds seed cotton.

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The importance of these figures is emphasized by the fact that about 75% of the cultivated land in the hill section of Mississippi is of a sandy texture, and half of the commercial fertilizer used in the State is applied to cotton on these soils.

Following publication of these data, the Mississippi legislature passed a law requiring fertilizer manufacturers to guarantee the acidity of their fertilizers, thus enabling farmers to know whether the mixtures they buy are acid-forming or neutral in their effect on the soil reaction. Thus, Mississippi joins Alabama, North Carolina, South Carolina, Georgia, and Virginia in requiring this guarantee. In addition, many manufacturers in fertilizer-using regions where acidity is considered an important factor, voluntarily give this guarantee, whether required to do so by law or not.

Use of Dolomite In Fertilizers Increased Greatly

Since the manufacture of non-acid-forming fertilizers was started in 1934, the use of dolomitic limestone in fertilizer mixtures has increased greatly. The average net equivalent acidity of commercial mixed fertilizers in 1933 was about 152 pounds calcium carbonate, limestone. However, by 1936, U. S. Department of Agriculture figures show that the equivalent acidity was only 19 pounds calcium carbonate.

Another favorable effect resulting from the use of larger amounts of dolomitic limestone has been the increase in the magnesia content of mixed fertilizers. Farmers in this country in 1930 used 8,407,000 tons of commercial fertilizers containing 61,000 tons of MgO. Since 1930, the average MgO content of commercial fertilizers increased from 0.7 per cent to 1.4 per cent. The 8,451,000 tons of commercial fertilizers used in 1937 contained 114,000 tons MgO, or nearly double the 1930 tonnage.

Another important effect has been to provide conditions whereby the low-cost sources of nitrogen give just as good agronomic results as do the more expensive forms.

Influence of Various Nitrogen Carriers on Soil Reaction

Mississippi Experiment Station Bulletin 338 points out that since fertilizer manufacturers and farmers use many different nitrogen materials in their mixtures, it is important that they take into consideration the influence of these materials on soil reaction. For instance, when they use ammonium sulphate or ammonium phosphate, they must allow for the fact that these materials are very acid in their effect on soils. In fact, a ton of ammonium sulphate causes a loss of bases from the soil equivalent to 2,200 pounds of calcium carbonate.

Sodium nitrate, calcium nitrate, potassium nitrate, and calcium cyanamide, on the other hand, are slightly basic. Their use tends to conserve soil bases

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and to prevent an increase in soil acidity. "Uramon"* fertilizer compound, cottonseed meal, fish scrap, process tankage, Urea-Ammonia Liquor, aqua ammonia, and Nitrogen Solution II are slightly acid. A given amount of nitrogen from these materials produces about one-third as much acid as an equivalent amount of nitrogen from ammonium sulphate.

In this connection, a copy of our table showing "The Nitrogen Content and Equivalent Acidity of Fertilizer Materials" and our pad of "Fertilizer Formula Sheets" will be sent on request to the Ammonia Department, E. I. du Pont de Nemours & Company, (Inc.), Wilmington, Delaware.

*"Uramon" is a trade-mark registered in U. S. Patent Office by E. I. du Pont de Nemours & Company, Wilmington, Del. "Uramon" contains 42% urea nitrogen.
